Development of Strained-Layer Superlattice (SLS) IR Detector Camera

Completed Technology Project (2012 - 2013)

Project Introduction

Strained Layer Superlattice (SLS) detectors are a new class of detectors which may be the next generation of band-gap engineered, large format infrared detector arrays with substantially higher quantum efficiencies than existing quantum well infrared photodetectors (QWIPs) and provide a competitive alternative to the current state-of-the-art mercury cadmium telluride and QWIP detector arrays. The anticipated advantages of SLS detector technology over existing IR detectors are: high sensitivity, band-gap tunable wavelength response (similar to QWIPs), warmer operating temperatures, array spectral uniformity (yet to be realized), high temporal stability, relatively low cost of manufacturing, scalability (to very large format arrays) and multiple vendor sources all contributing to higher performing scientific instruments. Previously, (in our FY12 IRAD "Strained Layer Superlattice Infrared Detector Array Characterization") we verified that these devices exhibit a dramatic increase in quantum efficiency (QE) over quantum well infrared photodetectors (QWIPs) and are approaching QE values comparable with mercury cadmium telluride and indium antimonide detectors.   This a major technological breakthrough, yet before we embark on an expensive in-house program to design and fabricate SLS detectors it would be very valuable to build an IR camera system using the existing SLS array we currently have and perform experimental field tests.

Strained Layer Superlattice (SLS) detectors are a new class of detectors.   In our FY12 IRAD "Strained Layer Superlattice Infrared Detector Array Characterization" we verified that these devices exhibit a dramatic increase in quantum efficiency (QE) over quantum well infrared photodetectors (QWIPs) and are approaching QE values comparable with mercury cadmium telluride and indium antimonide detectors.   The anticipated advantages of SLS detector technology over existing IR detectors are: high sensitivity, band-gap tunable wavelength response (similar to QWIPs), warmer operating temperatures, array spectral uniformity (yet to be realized), high temporal stability, relatively low cost of manufacturing, scalability (to very large format arrays) and multiple vendor sources all contributing to higher performing scientific instruments. Warmer and more stable focal planes lead to simpler instrument designs which result in higher reliability, longer mission lifetimes and reduced costs.   In our FY12 IRAD we obtained a test SLS array and performed extensive tests to ascertain the veracity of researcher claims, as well as to assess the potential applications to NASA missions from a practical infusion standpoint.   The most important result of that investigation was the verification of the (unexpected) very high QE. However, along with the dramatic improvement in QE we measured much higher dark current and the array was quite non-uniform. Before we embark on an ambitious in-house program to design and fabricate SLS detectors it would be very valuable to build an IR camera system using the existing SLS array we currently have and perform some local field tests. We believe that actual IR imaging of external environment scenery will prove most valuable.

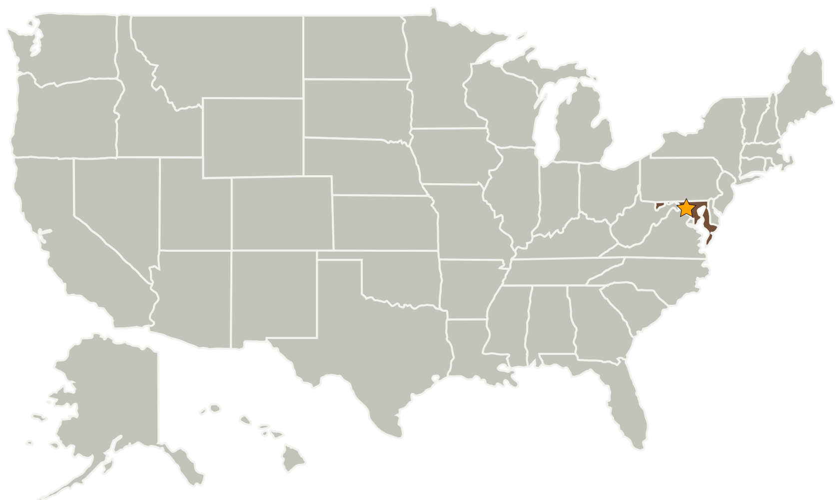
Development of Strained-Layer Superlattice (SLS) IR Detector Camera

Table of Contents

Anticipated Benefits

This technology requires further validation before it can be considered for existing missions. However, near term prospects include upcoming Landsat missions, possibly exoplanet exploration, planetary observations yet to be defined.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Innovation Fund: GSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Peter M Hughes

Project Manager:

Matthew J Mcgill

Principal Investigator:

Murzban D Jhabvala

Development of Strained-Layer Superlattice (SLS) IR Detector Camera

Completed Technology Project (2012 - 2013)

Images

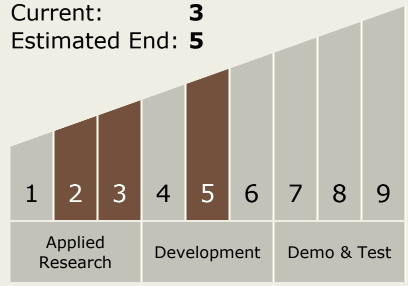
11808-1364480120087.jpg
Development of Strained-Layer Superlattice (SLS) IR Detector Camera
(https://techport.nasa.gov/image/1887)

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  └─ TX08.1 Remote Sensing Instruments/Sensors
    └─ TX08.1.1 Detectors and Focal Planes